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(54) VEE BOTTOM STRUCTURE FOR BOAT.

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Description

The present invention concerns a bottom construction for a boat, as specified in the preamble to Claim 1.

In designing the bottom structure of fast, planing boats endeavours are to minimize the water resistance, or the wet surface area of the boat, at the same time maintaining good running characteristics, directional stability and steerability of the boat.

One has in prior art attempted to improve the running characteristics of a boat by means of various transversal step designs with which the water flows are guided in desired manner underneath the bottom, and by which the boat is made to rise higher, thereby reducing the wet surface. Likewise known in bottom designs of prior art are various grooves, channels and other guides longitudinal to the boat, by which one attempts to maximize the favourable action of water flows under the bottom.

The problem associated with most bottom designs of prior art is, however, their high planing ascent threshold, that is, when the speed is accelerated the bow of the boat rises up steeply, and only after having gained a certain speed the bow sinks down and the boat rises and begins to plane. However, the boat keeps planing even at considerably lower speed.

The second problem with boats of prior art consists of its planing properties in sharp curves. If the hull shape in boats of prior art at all enables sharp turns at high speed, the hull sinks to rather great depth in the water, as a consequence of which the speed of the boat drops strongly, whereafter the planing ascent threshold has to be exceeded once more, in order to regain the original speed.

The third problem in fast boats of prior art consists of the powerful centrifugal forces in curves, a circumstance which significantly impedes any work done in a fast-moving boat. It also causes operating trouble in the case of various pieces of technical equipment, e.g. the armament which naval forces use in fast boats.

The object of the invention is to eliminate the drawbacks mentioned. In particular, the object of the invention is to provide a novel boat bottom construction which has no planing ascent threshold, which is nearly insensitive to various loads, which presents good steerability within the whole speed range of the boat, by which the detrimental effects of the centrifugal forces acting in curves can be eliminated, and by which the speed of the boat can be significantly increased without increasing the engine power.

Regarding the features which are characteristic of the invention, reference is made to the claims section.

The boat bottom structure of the invention is defined by the features of claim 1.

Thus, in practice, the boat bottom of the invention comprises three side-by-side bottoms having mutually parallel keel lines. When travelling with such a boat straight forward or through a gentle curve, the boat runs on the central bottom, while sharper curves are negotiated running on one or the other side bottom, which operates with equal smoothness and stability in curves as the central bottom in straight runs.

Moreover, for instance when running obliquely into head waves the boat runs on two bottoms. In that case the central bottom rides upon the underlying water, and the side bottom takes on the waves coming from the beam, distributing them on either side of its own keel line. Hereby no waves coming from any direction whatsoever can hit at right angles against the sides of the boat; the different bottoms will at any time meet the water smoothly and with flexible guiding effect, whereby the pressures exerted by the water are uniformly distributed among the different bottoms and the boat runs in a stable and smooth manner in any and all circumstances, both on straight runs and in curves.

The side bottom may be wider than the central bottom by 0 to 20%, advantageously 0 to 10%, e.g. about 0 to 5%. The somewhat greater width of the side bottom, compared with that of the central bottom, ensures that the boat will present firm and safe tilting characteristics in curves, since a wider side bottom has a higher buoyancy effect than the narrower central bottom when the boat is in a tilted attitude, so that the boat tends to right itself to vertical position and capsizing is nearly impossible.

The keel angle may be 120° to 170°, advantageously 130° to 160°, e.g. about 140° to 150°. The bottom angle may be 130° to 170°, advantageously 140° to 160°, e.g. about 150° to 160°.

When, as taught by the invention, both bottom angles are greater than the keel angle between them, exceedingly stable running of the boat is thereby ensured because when the boat is running so that the keel line as well as one bottom line are submerged, the side bottom extending outward from the bottom angle is positioned at a gentler slope against the water surface than the central bottom extending outward from the keel line on the opposite side of the wet surface. Thereby the side bottom produces a higher buoyant force, righting the boat.

Advantageously, in the bottom construction of the invention the central bottoms and side bottoms in aggregate constitute the whole bottom structure of the boat, up to its deck level. It is thus understood that

the hull of the boat comprises no substantially vertical sides longitudinal to it: the vertical structural components of the boat, if any, are only erected above deck level. Hereby, in the bottom structure of the invention th whole outside surface of the hull, up to deck level, constitutes a shell which forms the wet surface that is used in each instance, depending on the boat's attitude. Th deck structures provided on the boat can vary freely, depending on the particular application. The structure may be completely open or partly open, or substantially fully closed. The deck superstructure may consist of various cockpit spaces and cabins, and of various armament arrangements including ancillary accessories.

Advantageously, the bottom lines between the central bottoms and the side bottoms run in one horizontal plane from the stern of the hull towards the bow, and they come together as the keel line, curving upward between them, intersects said plane.

Advantageously, in the bottom structure of the invention the central bottoms as well as the side bottoms are substantially straight planes in the longitudinal as well as lateral direction, up to a given distance bowwards from the stern of the boat, whereafter they curve uniformly, and taper, to form the pointed bow structure of the boat in such manner that only the side bottoms extend all the way to the point of the bows, while the central bottoms taper down around the keel line and terminate at a distance from the point of the bows towards the stern.

Advantageously, in the bottom structure of the invention the central bottoms as well as the side bottoms are substantially straight in the direction longitudinal to the boat, whereas in the direction across the boat they represent an outwardly convex, arcuate structure, up to a given distance from the bows towards the stern, whereafter they curve uniformly and taper down to form the pointed bow structure of the boat. It is equally conceivable that the side bottoms alone, or the central bottoms alone, are outwardly convex in the longitudinal direction while the other bottoms are straight planes both longitudinally and laterally.

Advantageously, the substantially uniform and unchanged hull cross section extending from the stern of the boat towards the bows extends over 15 to 60%, possibly 20 to 50%, e.g. about 30 to 40%, of the boat's total length.

In an embodiment of the invention, the central bottoms abut on each other on the keel line so that they form together a comparatively sharp-edged keel angle. It is however equally conceivable that in the keel region is provided a comparatively narrow, even keel plane on the margins of which the central bottoms abut.

It is also possible in the bottom structure of the invention to use various kinds of transversal stepped structures such as are employed in various connections: one or several steps at the very stern of the boat or at a certain distance from the stern. They do not change the inventive bottom design of the boat nor its function in curve conditions and in heavy sea, but they may afford good additional features in the boat's behaviour, depending on its size and on the conditions in which it is used.

In the hull design of the invention, advantageously, following after the substantially constant cross section of the hull the keel line curves substantially uniformly upward, the bottom lines formed by the bottom angles curve substantially uniformly upward and towards each other, and the side lines of the side bottoms on deck level curve substantially uniformly in horizontal direction towards each other, so that these lines confine and form the tapering bow part of the boat's hull. The curvature to which reference has been made in the foregoing extends, advantageously, over about half the length of the boat, whereby for instance the radius of curvature of the keel line will be on the order of the boat's length or larger.

Advantageously, the bottom structure of the invention comprises ascent mouldings running in parallel with the keel line and provided symmetrically on either side thereof, which may be attached either to the central bottom or to the side bottoms, or to both, and/or to their boundary surfaces.

The bottom structure of the invention can be used on boats of various types and sizes, and therefore its length may vary within 5 to 50 m, for instance. Since the hull structure of the invention is designed to be mainly used in heavy professional service of the naval forces and coast guard, furthermore possibly fitted with comparatively heavy armament and engine power, and which may get up to speeds between 50 and 100 knots, the hull length varies advantageously within 8 to 20 m in said applications. Therefore the weight of a boat according to the invention is advantageously over 1000 kg, e.g. on the order of 3000 to 5000 kg, while it may be rather much greater as well.

The engine power is in no way limited in a boat according to the invention: it may vary, depending on required top speeds and on boat size and weight, from a few hundred to several thousand hp, even up to several ten thousand hp. For engines, various types of inboard motor, inboard stern motor or outboard motor can be used, and the propeller may be totally immersed or disposed half above the water surface. It is equally possible to apply in the boat, various water jets and turbines, dep nding on particular application and desired performanc charact ristics.

The stern of the bottom structure of the invention may be vertical and even, but it may equally be upward or downward inclined. Likewise, inward pointing steps known in themselves in the art may be provided on the rear margin of the bottom, close to the stern.

The ratio of the boat's hull breadth and length is less than 0.35, advantageously 0.32 to 0.15, .g. 0.30 to 0.20, whereby the hull is comparatively pointed and long relative to its breadth, compared with conventional fast boats used by the naval forces and the coast guard, for instance.

When the boat bottom structure of the invention is put through curves, the hull is arranged to tilt and curve in such a way that the resultant force of gravitation and of the centrifugal force acting on an object in the boat, caused by the curved travel, will virtually always act perpendicularly downward against the horizontal bottom plane of the boat. It is therefore an easy thing to stand upright in a boat according to the invention, even under high speed and in abrupt turns, because no objectionable lateral forces occur. This is of immense significance regarding operation of various armament systems, seeing that even in curves all the forces acting on the structures are directed downward in the case of various mechanical firearms as well as missiles; all these will therefore be constantly fully operable and fit to be used even when the boat is run at full speed through sharp curves.

The bottom structure of the invention affords the following advantages over the state of art:-

- the bottom structure has no planing ascent threshold - it rises to planing smoothly and without steps with increasing speed, without any upthrust of the bows;
- thanks to the bottom structure no objectionable centrifugal forces occur in the boat;
- the bottom structure is comparatively insensitive to weight changes, and it has good carrying capacity;
- the bottom structure presents good steerability throughout the speed range;
- in choppy water and in heavy seas the water-induced pressures are so distributed on the bottom that the boat of itself rights those movements which are due to wave action;
- in spite of its light weight, the structure is strong, and favourable as regards building costs;
- the hull is comparatively low-slung and therefore presents a minimal wind surface; and
- the structure has a small wet surface, which is conducive to high maximum speeds without detriment to directional stability.

In the following the invention is described in detail with reference to the drawings hereto attached, wherein:-

Fig. 1 presents a bottom structure according to the invention,

Fig. 2 presents another bottom structure according to the invention,

Fig. 3 shows the bottom structure of Fig. 2 in elevational view,

Fig. 4 presents a section of the bottom structure of Fig. 1,

Fig. 5 presents a section of the bottom structure of Fig. 2,

Fig. 6 presents a bottom structure according to the invention and its wet surface during a straight run,

Fig. 7 presents a bottom structure according to the invention and the corresponding wet surface during a gentle turn,

Fig. 8 presents a bottom structure according to the invention and the corresponding wet surface during a sharp turn, and

Fig. 9 displays a diagram of the bottom structures presented in Table 1.

The Vee bottom structure of a fast-running boat according to the invention, depicted in Fig. 1, consists of sides 4 which are symmetric relative to the keel line 3 and join each other in the forward part of the boat to produce pointed bows 2, and of a plate-like stern 1 perpendicular against the keel line and substantially vertical. The sides 4 consist of central bottoms 6 abutting on the keel line and positioned at an angle to each other, and of side bottoms 7 which constitute the shell of the hull, from the outer margins of said central bottoms up to the deck plane 12 of the hull.

The central bottoms 6 consist of substantially smooth and straight plates extending from the stern 1 with uniform width up to a distance toward the bow 2, said distance being, in the present embodiment, about 30% of the boat's length. Thereafter the central bottoms taper down bowwards and join to form a sharp point 15 on the keel line 3, at a distance from the bow 2 towards the stern 1.

The central bottoms form on the keel line 3 a keel angle 8, this angle being for instance 144°, in a prototype corresponding to the figure that has been manufactured. However, the angle may vary in accordance with the boat's dimensions and with those properties which are desired. The prototype now in question has a length of about 10 m, and its breadth is about 3 m.

The side bottoms 7 constitute, lik wise similarly as the central bottoms 6, on a stretch of about 30% from the stern, a straight and smooth part of the shell of the boat's hull, this shell part being positioned at an angle to the central bottom on the respective side. Hereby a bottom angle 9 is formed between the

central bottom and the side bottom, the bottom line 11 defined by this angle on the bottom of the boat being substantially parallel to the boat's keel line over the said 30% of the boat's total length from the stern towards th bows. Similarly, the upper margins of the side bottoms 7, i.e., their margins abutting on the deck level 12, parallel the bottom lines 11 and the keel line 3, so that the cross section configuration of the boat's hull is constant over said distance of about 30%.

The bottom angle 9 between the side bottoms 7 and the central bottoms 6 may be e.g. 153°, but its magnitude may likewise vary on different types of hull. The upper margin of the side bottom 7 in the deck plane 12, or the side line 13, curves after the straight portion fairly gently towards the bows 2 of the boat so that the side bottoms run together from the boat's sides and join in the bow region on the keel line 3, forward of the sharp point 15 formed by the central bottoms, to form a bow structure which is pointed and slightly upward curving from the stern deck plane.

The boat bottom structures depicted in Figs 2, 3 and 5 differ from those of Figs 1 and 4 only in that ascent mouldings 14 have been attached to them. In the embodiment here depicted there are three pairs of ascent mouldings, and they are attached to the bottom line 11 between the central bottoms 6 and the side bottoms 7, on the centre-line of the central bottoms substantially parallel with the bottom lines 11 and at a distance from the bottom lines, substantially parallelling the bottom lines 11. The ascent lines need not absolutely extend all the way up to the keel line 3 in the bows to meet each other, but it is essential that the ascent lines parallel the keel line 3 all through the constant cross section area of the hull structure's stern part.

In Fig. 6 is shown the cross section of a bottom structure according to the invention in its normal. upright position upon the water surface 16. Then, if the boat is planing, the configuration of the wet surface is an isosceles triangle, its base 17 substantially constant but its height varying in accordance with the boat's speed.

As can be seen in Fig. 7, with the boat running through a gentle curve and when one of the central bottoms 6 is parallel with the water surface 16, the wet surface 5 assumes, as in Fig. 7, the configuration of an isosceles trapeze.

As shown in Fig. 8, when the boat is put through a sharp turn so that one side bottom 7 is parallel with the water surface, the wet surface 5 becomes a quadrangle as seen in Fig. 8.

The configuration of the wet surface varies in the way illustrated by Figs. 6 to 8, depending on how steep a curve is being negotiated. However, the total area of the wet surface does not change substantially: it is roughly constant all the time. Hereby the resistance from the water is substantially constant, and the boat travels with comparatively uniform speed also in curves and sharp bends, and even in heavy sea.

Table 1

Boat I										
Stern	Relative boat length									Bows
0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
b 0.28	0.28	0.28	0.28	0.28	0.26	0.21	0.14	0.02	0	0
c 0.5	0.5	0.5	0.5	0.5	0.49	0.44	0.38	0.29	0.16	0
α 18°	18°	18°	18°	18°	19°	22°	27°	33°	-	-
ß 45°										
Boat II										
b 0.29	0.29	0.29	0.29	0.28	0.24	0.19	0.11	0	0	0
c 0.5	0.5	0.5	0.5	0.49	0.47	0.43	0.36	0.26	0.14	0
α 17°										
ß 45°										

Referring to Fig. 9, in Table 1 are presented the longitudinal profiles of the bottom structures of two prototypes that hav b n built. The lengths of these two prototypes were on the order of 8 to 10 m. The angle α is the acute angle between the horizontal plane and the central bottom 6, and the angle β is the acute angle between the horizontal plane and the side bottom 7. The symbol c stands for one half of the total breadth of the boat's bottom structure, compared with the boat's breadth at the stern, and b stands for the relative breadth of the central bottom 6, i.e., the length of its horizontal projection related to the boat's breadth at the stern.

As can be seen in Table 1, the hull structure of boat I is uniform in thickness from the stern towards the bow up to a given distance, which is in the range of 0.4 to 0,5 of the boat's length, the breadth of this uniformly thick portion of the boat also being the maximum breadth of the boat. The value of b may advantageously vary in the range from 0.24 to 0.32 on the uniformly thick part of the hull, and c is in the range from 0.46 to 0.54.

The angle α , which is 18° on the uniform part of the hull structure, may in different embodiments vary in the range of 9° to 22°. These values correspond to keel angle 144°, respectively to the range of 136° to 162°. Likewise, the angle β , which is 45° on the uniform portion of the hull structure, may in different embodiments vary, on the uniform portion, in the range of 35° to 50°, which corresponds, also depending on the angle α , to values of the bottom angle in the range of 139° to 167°.

Boat II is otherwise substantially similar to Boat I as to its hull structure, except that the angle α is slightly smaller and the hull is uniform in thickness, from the stern toward the bows, only on the interval up to 0.3 to 0.4 of the boat's length, whereafter it tapers down comparatively uniformly. The relative length of the projection b is also somewhat greater, owing to reduction of the angle α .

In the foregoing, the invention has been described by way of example with the aid of the enclosed drawings, while different embodiments of the invention are feasible within the scope of the inventive idea delimited by the claims.

Claims

1. A Vee bottom structure for a boat, for use on fast, planing boats, comprising a stern (1), a bow (2) and sides (4) which are symmetrical relative to a vertical plane through the keel line (3) and which constitute an outwardly substantially convex structure, and further comprising a part extending from the stern (1) towards the bow (2) up to a certain distance, this part consisting of central bottoms (6) which are positioned at an angle to each other beside the keel line (3) on either side thereof, and of side bottoms (7) extending outward from the outer margins of said central bottoms and positioned at an angle against the central bottom on the respective side,
   characterized in that up to a certain distance from the stern (1) towards the bow (2):
   - the bottom line (11) between the central bottom (6) and the side bottom (7) is parallel with the keel line (3),
   - the breadth of the side bottom (7) is at least equal to the breadth of the central bottom (6), and
   - the bottom angle (9) between the central bottom (6) and the side bottom (7) is at least equal to the keel angle (8) between the central bottoms.

2. Bottom structure according to claim 1, characterized in that the side bottom (7) is 0 to 20% wider than the central bottom (6), advantageously e.g. about 0 to 5% wider.

3. Bottom structure according to claim 1, characterized in that the keel angle (8) is in the range of 120° to 170°, advantageously 130° to 160°, e.g. 140° to 150°.

4. Bottom structure according to claim 1, characterized in that the bottom angle (9) is in the range of 130° to 170°, advantageously 140° to 160°, e.g. 150° to 160°.

5. Bottom structure according to any one of claims 1-4, characterized in that the central bottoms (6) and the side bottoms (7) in combination constitute the bottom structure of the boat up to the level of its deck plane (10).

6. Bottom structure according to any one of claims 1-5, characterized in that the bottom structure comprises one or several transversal step structures in the stern part of the bottom structure and/or on a certain distance from the stern (1) towards the bow (2).

7. Bottom structure according to any one of claims 1-6, charact rized in that the bottom lines (11) run in one plane, e.g. in the horizontal plane, from the stern (1) of the hull, coming together with the upward curving keel line (3).

8. Bottom structure according to any one of claims 1-7, characterized in that the central bottom (6) and the side bottom (7) are substantially straight planes both in the longitudinal and lateral direction, up to a certain distance towards the bow (2) from the stern (1) of the boat.

9. Bottom structure according to any one of claims 1-7, characterized in that the central bottom (6) and the side bottom (7) are planes which are straight in the longitudinal direction of the boat and outwardly convex in the lateral direction, up to a certain distance towards the bow (2) from the stern (1) of the boat.

10. Bottom structure according to any one of claims 1-7, characterized in that the central bottom (6) and the side bottom (7) are straight in the longitudinal direction and straight and outwardly convex/respectively outwardly convex and straight, up to a certain distance towards the bow (2) from the stern (1) of the boat.

11. Bottom structure according to any one of claims 1-10, characterized in that the substantially uniform and unchanged hull cross section extends from the stern (1) of the boat 15 to 60% of the boat's length, advantageously 20 to 50%, e.g. about 30 to 40%.

12. Bottom structure according to any one of claims 1-11, characterized in that the central bottoms (6) abut on each other immediately on the keel line (3), forming a keel angle (8).

13. Bottom structure according to claim 11, characterized in that after the substantially unchanging cross section of the hull the keel line (3), the bottom lines (11) formed by the bottom angles (9) and the margin lines (13) of the side bottoms (9) on deck (12) level curve substantially smoothly forward and upward towards each other, forming the pointed bow part of the boat's hull.

14. Bottom structure according to any one of claims 1-13, characterized in that on the bottom, from the stern (1) towards the bow (2) and symmetrically with reference to a vertical plane through the keel line (3), belong ascent mouldings (14) attached to the central bottoms (6), to the side bottoms (7) and/or to the bottom lines (11) therebetween.

15. Bottom structure according to claim 14, characterized in that the ascent mouldings (14) extend substantially over the whole length of the boat, curving in the bows (2) into the vicinity of the keel line (3) curving towards the deck plane (12) of the hull.

16. Bottom structure according to any one of claims 1-15, characterized in that the length of the boat's hull is in the range of 5 to 50 m, advantageously 8 to 20 m.

17. Bottom structure according to any one of claims 1-16, characterized in that thr ratio of the boat's hull breadth to its length is less than 0.40, advantageously in the range of 0.32 to 0.10, e.g. 0.30 to 0.20.

18. Bottom structure according to any one of claims 1-17, characterized in that the part extending from the stern (1) towards the bow (2) up to a certain distance extends at least to the region of the wet surface which the boat uses when planing.

19. Bottom structure according to any one of claims 1-18, characterized in that the wet surface of the bottom structure in planing changes configuration at different degrees of sharpness of the curves, yet its area is substantially constant at any given speed.

Patentansprüche

1. V-förmige Bodenstruktur für ein Boot zur Verwendung bei schnellen Gleitbooten, welche Bodenstruktur umfaßt ein Heck (1), einen Bug (2) und Seit nbereiche (4), die relativ zu einer vertikalen Ebene durch die Kiellinie (3) symmetrisch sind und eine nach außen im wesentlichen konvexe Struktur bilden und

weiter einen Teil umfassen, der sich bis zu einem gewissen Abstand vom Heck (1) zum Bug (2) hin erstreckt, welcher Teil besteht aus Zentralböden (6), die mit einem Winkel zueinander auf beiden Seiten der Kiellinie (3) des Bootes angesetzt sind, und aus Seitenböden (7), die sich von den Außenrandbereichen der Zentralböden ab nach außen erstrecken und mit ein m Winkel gegen den Zentralboden der jeweiligen Seite angesetzt sind,
dadurch gekennzeichnet, daß bis zu einem gewissen Abstand vom Heck (1) in Richtung zum Bug (2):

- die Bodenlinie (11) zwischen dem Zentralboden (6) und dem Seitenboden (7) jeweils parallel zur Kiellinie (3) ist,
- die Breite des Seitenbodens (7) mindestens gleich der Breite des Zentralbodens (6) ist, und
- der Bodenwinkel (9) zwischen dem Zentralboden (6) und dem Seitenboden (7) mindestens gleich dem Kielwinkel (8) zwischen den Zentralböden ist.

2. Bodenstruktur nach Anspruch 1, **dadurch gekennzeichnet,** daß der Seitenboden (7) 0 bis 20% breiter als der Zentralboden (6) ist, bevorzugt z.B. etwa 0 bis 5% breiter.

3. Bodenstruktur nach Anspruch 1, **dadurch gekennzeichnet,** daß der Kielwinkel (8) im Bereich von 120° bis 170°, bevorzugt von 130° bis 160°, z.B. von 140° bis 150° liegt.

4. Bodenstruktur nach Anspruch 1, **dadurch gekennzeichnet,** daß der Bodenwinkel (9) im Bereich von 130° bis 170°, bevorzugt 140° bis 160°, z.B. 150° bis 160° liegt.

5. Bodenstruktur nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet,** daß die Zentralböden (6) und die Seitenböden (7) zusammen die Bodenstruktur des Bootes bis zum Niveau seiner Deckebene (10) bilden.

6. Bodenstruktur nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet,** daß die Bodenstruktur eine oder mehrere Querstufen-Struktur(en) im Heckteil der Bodenstruktur und/oder mit einem gewissen Abstand vom Heck (1) in Richtung zum Bug (2) umfaßt.

7. Bodenstruktur nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet,** daß die Bodenlinien (11) in einer Ebene, z.B. in der Horizontalebene, vom Heck (1) des Bootskörpers verlaufen, und mit der bogenförmig nach oben verlaufenden Kiellinie (3) zusammenkommen.

8. Bodenstruktur nach einem der Ansprüche 1 bis 7, **dadurch gekennzeichnet,** daß der Zentralboden (6) und der Seitenboden (7) bis zu einem gewissen Abstand vom Heck (1) zum Bug (2) des Bootes hin sowohl in Längs- wie in Querrichtung im wesentlichen gerade Ebenen sind.

9. Bodenstruktur nach einem der Ansprüche 1 bis 7, **dadurch gekennzeichnet,** daß der Zentralboden (6) und der Seitenboden (7) bis zu einem gewissen Abstand vom Heck (1) gegen den Bug (2) des Bootes hin Ebenen sind, die in Längsrichtung des Bootes geradlinig und in der Querrichtung nach außen konvex sind.

10. Bodenstruktur nach einem der Ansprüche 1 bis 7, **dadurch gekennzeichnet,** daß der Zentralboden (6) und der Seitenboden (7) bis zu einem gewissen Abstand vom Heck (1) des Bootes zum Bug (2) hin in der Längsrichtung gerade und geradlinig und nach außen konvex bzw. nach außen konvex und geradlinig sind.

11. Bodenstruktur nach einem der Ansprüche 1 bis 10, **dadurch gekennzeichnet,** daß der im wesentlichen gleichförmige und unveränderte Bootskörperquerschnitt sich von dem Bug (1) des Bootes zu 15 bis 60% der Bootslänge, bevorzugt 20 bis 50%, z.B. etwa 30 bis 40% erstreckt.

12. Bodenstruktur nach einem der Ansprüche 1 bis 11, **dadurch gekennzeichnet,** daß die Zentralböden (6) unmittelbar an der Kiellinie (3) unter Bildung eines Kielwinkels (8) aneinanderstoßen.

13. Bodenstruktur nach Anspruch 11, **dadurch gekennzeichnet,** daß nach dem im wesentlichen ungeänderten Querschnitt des Bootskörpers die Kiellinie (3), die durch die Bodenwinkel (9) gebildeten Bodenlinien (11) und die Seitenbegrenzungslinien (13) der Seitenboden (9) am Niveau des Decks (12)

im wesentlichen sanft nach vorne und oben aufeinander zu bogenförmig verlaufen und den zug spitzten Bugteil des Bootskörpers bilden.

14. Bodenstruktur nach einem der Ansprüche 1 bis 13, **dadurch gekennzeichnet,** daß zu dem Boden vom Heck (1) zu dem Bug (2) hin und symmetrisch mit Bezug auf eine vertikale Ebene durch die Kiellinie (3) Aufstiegsformungen (14) gehören, die an den Zentralböden (6), an den Seitenboden (7) und/oder den Bodenlinien (11) dazwischen angebracht sind.

15. Bodenstruktur nach Anspruch 14, **dadurch gekennzeichnet,** daß die Aufstiegsformungen (14) sich im wesentlichen über die gesamte Länge des Bootes erstrecken und im Bereich des Buges (2) bis in die Nähe der Kiellinie (3) und zu der Deckebene (12) des Bootskörpers hin bogenförmig verlaufen.

16. Bodenstruktur nach einem der Ansprüche 1 bis 15, **dadurch gekennzeichnet,** daß die Länge des Bootskörpers im Bereich von 5 bis 50 m, bevorzugt 8 bis 20 m liegt.

17. Bodenstruktur nach einem der Ansprüche 1 bis 16, **dadurch gekennzeichnet,** daß das Verhältnis der Bootskörperbreite zu seiner Länge kleiner als 0,40 ist, bevorzugt im Bereich von 0,32 bis 0,10 und z.B. 0,30 bis 0,20 liegt.

18. Bodenstruktur nach einem der Ansprüche 1 bis 17, **dadurch gekennzeichnet,** daß der sich bis zu einem gewissen Abstand vom Heck (1) zum Bug (2) hin erstreckende Teil sich mindestens zu dem Bereich der benetzten Fläche hin erstreckt, den das Boot beim Gleiten benutzt.

19. Bodenstruktur nach einem der Ansprüche 1 bis 18, **dadurch gekennzeichnet,** daß die benetzte Fläche der Bodenstruktur beim Gleiten ihre Gestalt mit unterschiedlichem Schärfegrad beim Kurvenfahren ändert, daß die Flächengröße jedoch bei einer bestimmten Geschwindigkeit im wesentlichen konstant bleibt.

Revendications

1. Structure de dessous de coque en V pour bateau, destinée à être utilisée sur des hydroglisseurs rapides, comprenant un étambot (1), une étrave (2) et des flancs (4) qui sont symétriques par rapport à un plan vertical passant par la ligne de quille (3) et qui constituent une structure sensiblement convexe vers l'extérieur, et comprenant en outre une partie qui s'étend à partir de l'étambot (1) vers l'étrave (2) jusqu'à une certaine distance, cette partie étant constituée par des fonds centraux (6) qui sont disposés de manière à former un angle entre eux auprès de la ligne de quille (3) de part et d'autre de celle-ci, et par des fonds latéraux (7) qui s'étendent vers l'extérieur à partir des bords externes desdits fonds centraux et qui sont disposés de manière à former un angle avec le fond central sur le flanc respectif,
   caractérisé en ce que jusqu'à une certaine distance de l'étambot (1) vers l'étrave (2),
   - la ligne de fond (11) entre le fond central (6) et le fond latéral (7) est parallèle a la ligne de quille (3),
   - la largeur du fond latéral (7) est au moins égale à la largeur du fond central (6) et
   - l'angle de fond (9) entre le fond central (6) et le fond latéral (7) est au moins égal à l'angle de quille (8) entre les fonds centraux.

2. Structure de dessous de coque selon la revendication 1, caractérisée en ce que le fond latéral (7) est plus large de 0 à 20% que le fond central (6), par exemple et de préférence plus large de 0 à 5% environ.

3. Structure de dessous de coque selon la revendication 1, caractérisée en ce que l'angle de quille (8) est compris entre 120° et 170°, de préférence entre 130° et 160°, par exemple entre 140° et 150°.

4. Structure de dessous de coque selon la revendication 1, caractérisée en ce que l'angle de fond (9) est compris entre 130° et 170°, de préférence entre 140° et 160°, par exemple entre 150° et 160°.

5. Structure de dessous de coque s lon l'une quelconque des revendications 1 à 4, caractérisée en ce que les fonds centraux (6) et les fonds latéraux (7) constituent en combinaison la structure de dessous de coque du bateau jusqu'au niveau du plan du pont (12) de celui-ci.

6. Structure de dessous de coque selon l'une quelconque des revendications 1 à 5, caractérisée en c qu'elle comprend une ou plusieurs structures de redan transversal s dans la partie arrière de la structure de dessous de coque et/ou sur une certaine distance à partir de l'étambot (1) vers l'étrave (2).

7. Structure de dessous de coque selon l'une quelconque des revendications 1 à 6, caractérisée en ce que les lignes de fond (11) s'étendent dans un plan, par exemple dans le plan horizontal, à partir de l'étambot (1) de la coque, se reunissant avec la ligne de quille (3) qui se courbe vers le haut.

8. Structure de dessous de coque selon l'une quelconque des revendications 1 à 7, caractérisée en ce que le fond central (6) et le fond latéral (7) sont des plans pratiquement rectilignes, tant dans la direction longitudinale que dans la direction laterale, jusqu'à une certaine distance vers l'étrave (2) à partir de l'étambot (1) du bateau.

9. Structure de dessous de coque selon l'une quelconque des revendications 1 à 7, caractérisée en ce que le fond central (6) et le fond latéral (7) sont des plans qui sont rectilignes dans la direction longitudinale du bateau et sont convexes vers l'extérieur dans la direction latérale, jusqu'à une certaine distance vers l'étrave (2) à partir de l'étambot (1) du bateau.

10. Structure de dessous de coque selon l'une quelconque des revendications 1 à 7, caractérisée en ce que le fond central (6) et le fond latéral (7) sont rectilignes dans la direction longitudinale et sont respectivement rectilignes et convexes vers l'extérieur/convexes vers l'extérieur et rectilignes dans la direction latérale, jusqu'à une certaine distance vers l'étrave (2) à partir de l'étambot (1) du bateau.

11. Structure de dessous de coque selon l'une quelconque des revendications 1 à 10, caractérisée en ce que la section transversale pratiquement uniforme et constante de la coque s'étend à partir de l'étambot (1) du bateau sur 15 à 60% de la longueur de celui-ci, de préférence sur 20 à 50%, par exemple sur 30 à 40% environ.

12. Structure de dessous de coque selon l'une quelconque des revendications 1 à 11, caractérisée en ce que les fonds centraux (6) se rencontrent directement sur la ligne de quille (3), en formant un angle de quille (8).

13. Structure de dessous de coque selon la revendication 11, caractérisée en ce qu'à la suite de la section transversale pratiquement constante de la coque, la ligne de quille (3), les lignes de fond (11) formées par les angles de fond (9) et les lignes de bord (13) des fonds latéraux (9) au niveau du pont (12) se rejoignent avec une courbure sensiblement adoucie vers l'avant et vers le haut, pour former la partie d'étrave pointue de la coque du bateau.

14. Structure de dessous de coque selon l'une quelconque des revendications 1 à 13, caractérisée en ce qu'il est prévu sur le dessous de coque, à partir de l'étambot (1) vers l'étrave (2) et symétriquement par rapport à la ligne de quille, des moulures inclinées (14) qui sont fixées aux fonds centraux (6), aux fonds latéraux (7) et/ou aux lignes de fond (11) entre ceux-ci.

15. Structure de dessous de coque selon la revendication 14, caractérisée en ce que les moulures inclinées (14) s'étendent pratiquement sur toute la longueur du bateau, en étant courbées dans l'étrave (2) au voisinage de la ligne de quille (3) qui se courbe vers le plan du pont (12) de la coque.

16. Structure de dessous de coque selon l'une quelconque des revendications 1 à 15, caractérisée en ce que la longueur de la coque du bateau est comprise entre 5 et 50 m, de préférence entre 8 et 20 m.

17. Structure de dessous de coque selon l'une quelconque des revendications 1 à 16, caractérisée en ce que le rapport de la largeur de la coque du bateau à sa longueur est inférieur à 0,40, de préférence compris entre 0,32 et 0,10, par exemple entre 0,30 et 0,20.

18. Structure de dessous de coque selon l'une quelconque des revendications 1 à 17, caractérisée en ce que la partie qui s'étend à partir de l'étambot (1) vers l'étrave (2) jusqu'à une certaine distanc s'étend au moins à la région de la surface mouillée que le bateau utilise en situation d'hydroplanage.

19. Structure de dessous de coque selon l'une quelconque des revendications 1 à 18, caractérisée en ce que la surface mouillée de la structure de dessous de coque en situation d'hydroplanage change de configuration pour des degrés différents de courbure des virages, alors que son aire est pratiquement constante pour toute vitesse donnée.

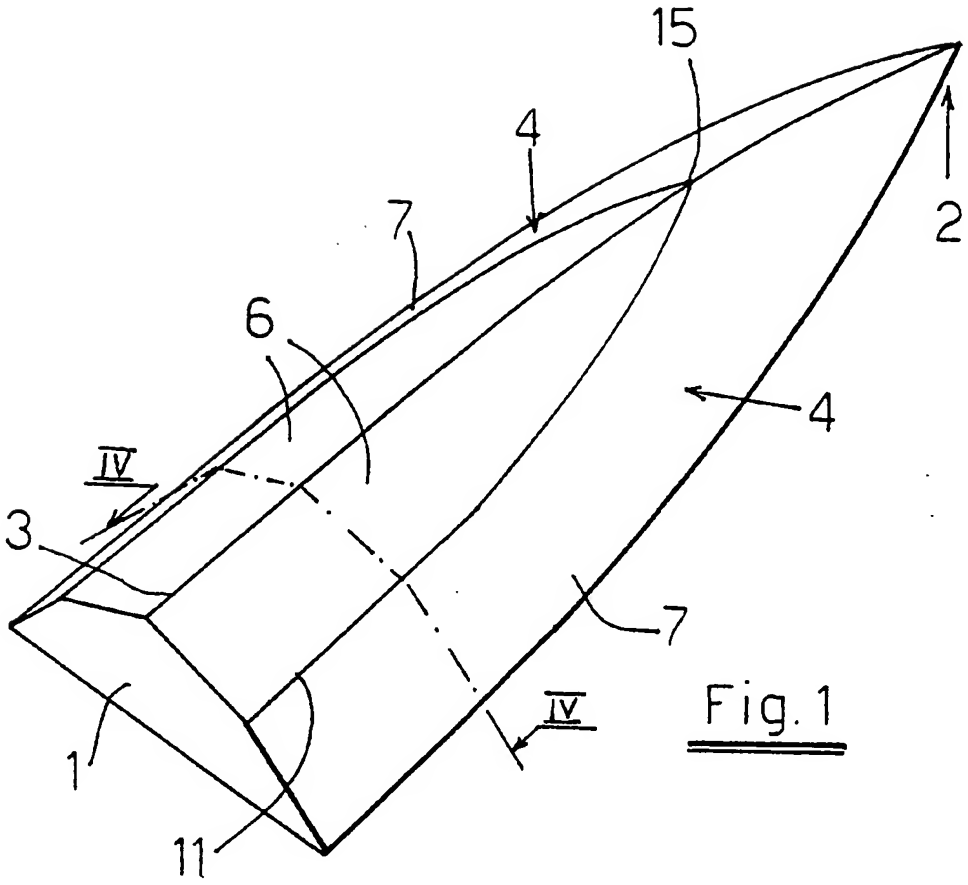
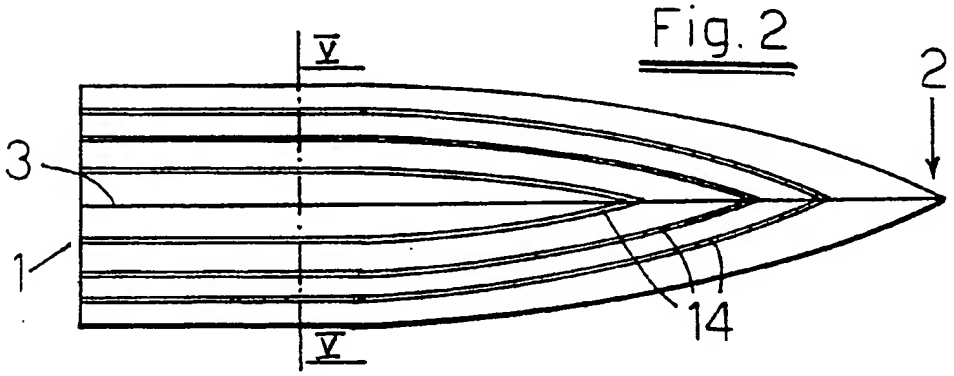


Fig. 1

Fig. 2



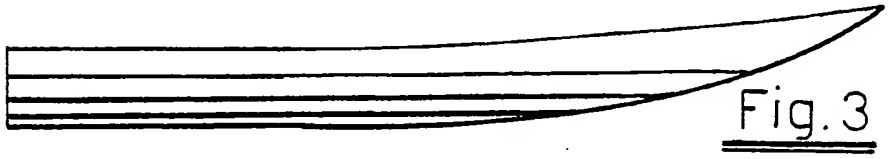


Fig. 3

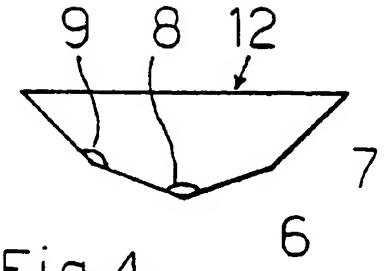


Fig.4

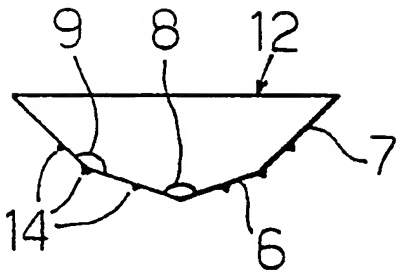


Fig.5

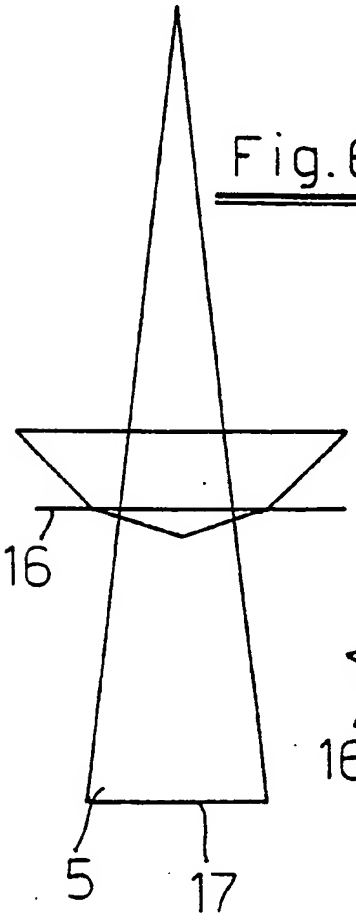


Fig.6

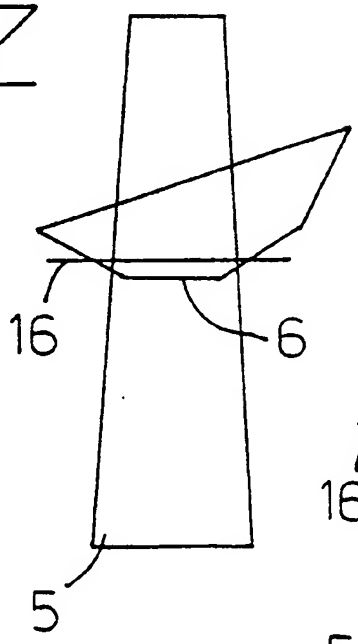


Fig.7

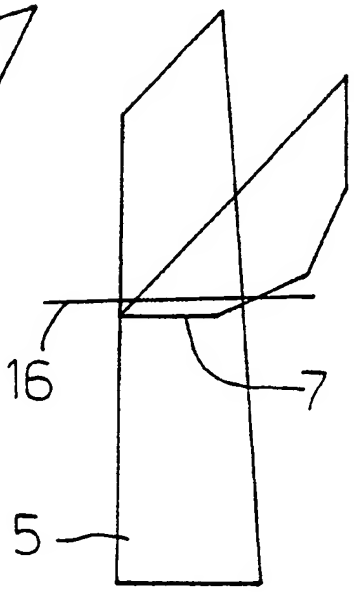


Fig.8

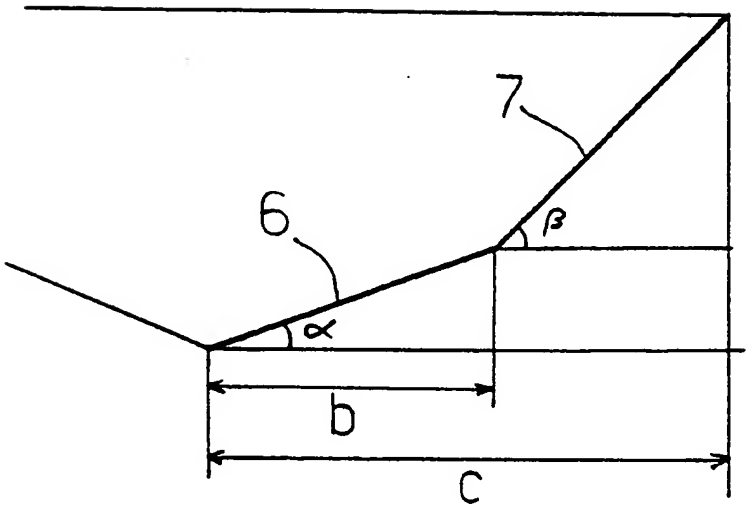


Fig. 9